WHAT IS CLAIMED:

1. A control system for use in adjusting a controlled variable representative of a system to be controlled, wherein the controlled variable is represented within an observable variable and at least two values of the controlled variable correspond to a single value of the observable variable, the control system comprising:

a signal source providing first and second values of the observable variable, the second value of the observable variable subsequent in time to the first value of the observable variable;

mapping logic, the mapping logic receiving the first value of the observable variable and outputting a first and a second possible value of the controlled variable;

a first estimator capable of estimating a future state of the system to be controlled, the first estimator taking as an input the first possible value of the controlled variable and producing a first output variable representative of a first predicted value of the observable variable responsive to the first possible value of the controlled variable;

a second estimator capable of estimating a future state of the system to be controlled, the second estimator taking as an input the second possible value of the controlled variable and producing a second output variable representative of a second predicted value of the observable variable responsive to the second possible value of the controlled variable; and

determining logic determining which of the first and second predicted values of the observable variable more accurately corresponds to the second value of the observable variable.

2. The control system of claim 1, wherein the determining logic compares an absolute value of the first predicted value with the second value of the observable variable and compares an absolute value of the second predicted value with the second value of the observable variable to determine which of the first and second predicted values of the observable variable corresponds to the second value of the observable variable.

3. The control system of claim 1, wherein the control system maintains the controlled variable near a nominal value and the nominal value is between the first and second possible values of the controlled variable.

4. The control system of claim 3, wherein the control system operates in accordance with discrete time intervals and wherein the first and second estimators receive the first and second possible values of the controlled variable only after the control system determines that the controlled variable will take values on above and below the nominal value.

5. A control system for a controlled variable representative of a system, wherein the system is characterized by an observable variable and wherein at least two values of the controlled variable correspond to a single value of the observable variable, the control system comprising:

a signal source providing first and second values of the observable variable, the second value of the observable variable subsequent in time to the first value of the observable variable;

mapping logic, the mapping logic receiving the first value of the observable variable and outputting a first and a second possible value of the controlled variable;

a first estimator capable of estimating a future state of the system to be controlled, the first estimator receiving the first possible value of the controlled variable and producing a first predicted value of the observable variable responsive to the first possible value of the controlled variable;

a second estimator capable of estimating a future state of the system to be controlled, the second estimator receiving the second possible value of the controlled variable and producing a second predicted value of the observable variable responsive to the second possible value of the controlled variable; and

determining logic determining which of the first and second estimators more accurately predicts the second value of the observable variable.

6. The control system of claim 5, wherein the determining logic compares an absolute value of the first predicted value with the second value of the observable variable and compares an absolute value of the second predicted value with the second value of the observable variable to determine which of the first and second predicted values of the observable variable corresponds to the second value of the observable variable.

7. The control system of claim 6, wherein the control system maintains the controlled variable near a nominal value and the nominal value is between the first and second possible values of the controlled variable.

8. The control system of claim 7, wherein the control system operates in accordance with discrete time intervals and wherein the first and second estimators receive the first and second possible values of the controlled variable only after the control system determines that the controlled variable will take values on above and below the nominal value.

9. A servo control system comprising the combination of:

a signal source providing an error rate function *f(y)* corresponding to a displacement y, the displacement y characteristic of a system to be controlled

a sampling circuit for sampling the value of *f(y)* at a sampling frequency of X_f to produce a function $f(y)_j$;

a map responsive to $f(y)_j$ to produce a positive value y_j^+ and a negative value y_j^-;

a first estimator responsive to y_j^+ to provide an estimated value $\hat{y}_{1,j}$;

a second estimator responsive to y_j^- to provide an estimated value $\hat{y}_{2,j}$; and

nonlinear logic responsive to $\hat{y}_{1,j}$ and $\hat{y}_{2,j}$ to generate an estimate $\hat{y}_k$ of the displacement.

10. A servo control system in accordance with claim 9, further comprising a second sampling circuit for sampling a value of a servo mechanism for providing a scalar position error output y at a sampling frequency of X_s to produce a value $y_{\bar{k}}$, and wherein the first and second estimators respond to the value $y_{\bar{k}}$ as an input thereto when produced by the second sampling circuit.

11. A servo control system in accordance with claim 10, wherein the sampling frequency X_f is substantially greater than the sampling frequency X_s.

12. A servo control system in accordance with claim 10, wherein the servo mechanism comprises a magnetic disk drive having a magnetic head laterally positionable relative to a plurality of concentric tracks on a rotatable disk, the disk having sectors of servo signal interspersed with recorded data and the magnetic head providing a signal from which is derived the error signal $f(y)$.

13. A method of estimating the value of an error signal in a servo control system, comprising the steps of:

determining an error rate of the servo control system;

sampling the error rate at a sampling frequency;

using a nonlinear map to determine scalar position error values corresponding to each sampled error rate;

generating positive and negative estimates of the absolute values of the scalar position error values; and

using nonlinear logic to generate an estimate of an actual error signal based on the positive and negative estimates.

14. A method in accordance with claim 13, wherein the step of using nonlinear logic includes the step of assuming that the sign of an absolute value has not changed since the last sampling thereof if the value of the absolute value is larger than a predetermined level.

15. A method in accordance with claim 13, wherein the step of using nonlinear logic includes the step of assuming that the sign of an absolute value has not changed since the last sampling thereof if the value of the absolute value is less than or equal to a predetermined level and the next sampling predicted value of the generated estimates has the same sign as the generated estimate of the previous step.

16. A method in accordance with claim 13, wherein the step of using nonlinear logic includes the step of determining if the value of an absolute value is less than or equal to a predetermined level when the next sampling predicted value of the value estimate has a sign opposite the sign of the value estimate of the previous sampling, and if so, then estimating the sign of the value by the steps of comparing the absolute values of the positive and negative estimates with the absolute values of the corresponding positive and negative signals values, and assuming that the sign of the absolute value is the sign of the positive and negative estimates whose output magnitude deviates the least from the input magnitude.

17. A method in accordance with claim 16, wherein the servo control system includes a magnetic head and means for positioning the magnetic head relative to a track of given width and the predetermined level comprises a predetermined fraction of the given width of the track.

18. A servo system for positioning a magnetic head relative to a track which is movable relative to the head, the track having a succession of bursts of servo signals therealong and data signals between the bursts of servo signals, comprising the combination of:

means responsive to the passage of the bursts of servo signals at the magnetic head for generating a first set of error signals;

means responsive to the passage of the data signals at the magnetic head for generating a second set of error signals; and

means responsive to the first and second sets of error signals for applying the position error signals from the first and second sets to correct the position of the magnetic head relative to the track.

19. A servo system in accordance with claim 18, wherein the rate of occurrence of the bursts of servo signals at the magnetic head defines a first sampling rate for the first set of position error signals, and the means responsive to the passage of the data signals at the magnetic head generates a second set of error signals at a second sampling rate which is substantially greater than the first sampling rate.

20. A servo system in accordance with claim 19, wherein the means for applying the position error signals from the first and second sets applies the signals at a correction rate which is greater than the first sampling rate and less than the second sampling rate.

74

21. A servo system in accordance with claim 20, wherein the first sampling rate is at 15 kHz, the second sampling rate is at 240 kHz, and the correction rate is at 60 kHz.

~~22. A servo system in accordance with claim 18, wherein the means responsive to the passage of the data signals at the magnetic head generates at least some of the second set of error signals by producing a pair of possible position error signal values in response to each sampling of the data track and processing the pair of possible position error signals values to choose one that best estimates position error of the magnetic head relative to the track.~~

22 ~~23~~. A servo system in accordance with claim 18 ~~22~~, wherein each pair of possible position error signal values includes a positive value and a negative value and the processing of the pair of possible position error signal values includes choosing one of the pair of possible position error signal values that appears to best estimate the position error.

~~24. A servo system in accordance with claim 18, wherein the means responsive to the passage of the data signals at the magnetic head generates each of the second set of error signals by generating a possible error signal during each of a succession of samplings of the data track and observing any changes in sign and absolute value of the possible error signal during the succession of samplings.~~